Family / Type	• Damper actuators / x Valve actuators
NM  NM24-MFT(2)	•
AM  AM24-MFT(2)	•
GM  GM24-MFT(2)	•
LF  LF24-MFT(2)	•
AF  AF24-MFT(2)	•
NV  NV24-MFT(2)	x
NVF  NVF24-MFT(2)(-E)	x
AV  AV24-MFT(2) *	x

*Delivery deadline on request, from 2002

Application
Traditional systems, Bus systems
Supplementary documentation

The following data is applicable to actuators for both dampers and valves

Application of ..24-MFT(2) damper and valve actuators

- Bus-capable ..24-MFT(2) damper actuators for operating air dampers
- Bus-capable ..24-MFT(2) valve actuators for operating globe valves

Traditional systems

Although they have a bus capability, the ..24-MFT(2) damper and valve actuators can also be used in traditional systems. They are parameterised with all the basic values for the usual applications before they leave the factory and are delivered in modulating-control form.

Customised versions with individually parameterised values can be ordered when needed.

For making service adjustments on-site MFT(2) actuators can be reprogrammed using an MFT-H Parameter Assignment Device or a Belimo PC-Tool.

Bus systems

		MFT actuator	MFT2 actuator
Bus linking and control	DDC controller with MP interface	•	•
	LonWorks®	via UK24LON	via UK24LON
	modulating	•	•
	3-point	•	•
	open/close	•	•
Sensor linking	active sensor On/Off switch	•	—
	active/passive sensor On/Off switch	—	•
Parameterisable with MFT parameterising tools	working range	•	•
	electronic angle-of-rotation limiting	•	•
	torque/force 1)	•	•
	direction of rotation	•	•
	running time	•	•
	position feedback	•	•

1) Not possible for actuators with a safety function

Changeover from conventional to bus operation is automatic as soon as the actuator is assigned an MP address over the MP-Bus.

Supplementary documentation
Additional general product data, instructions for use, etc. will be found in the information brochures for the individual product families.

Product Range for air: **2.NM, 2.AM, 2.GM, 2.LF und 2.AF**
Product Range for water: **6.H**

Family
Type

NM

NM24-MFT(2)

AM

AM24-MFT(2)

GM

GM24-MFT(2)

LF

LF24-MFT(2)

AF

AF24-MFT(2)

NV

NV24-MFT(2)

NVF

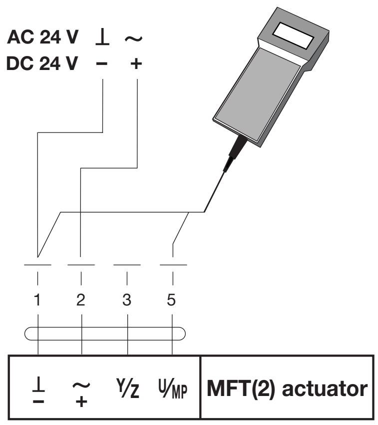
NVF24-MFT(2)(-E)

AV

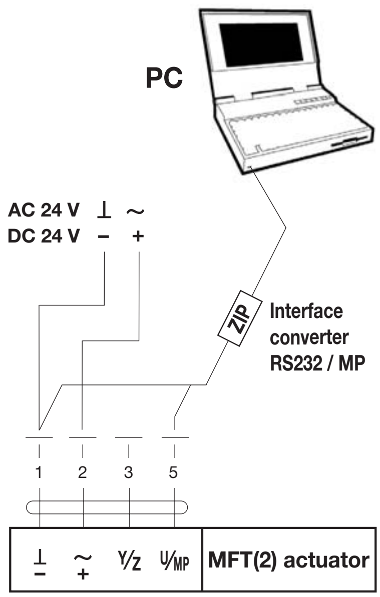
AV24-MFT(2) *

Connecting a parameterising tool

MFT-H Parameter Assignment Device



Belimo PC-Tool

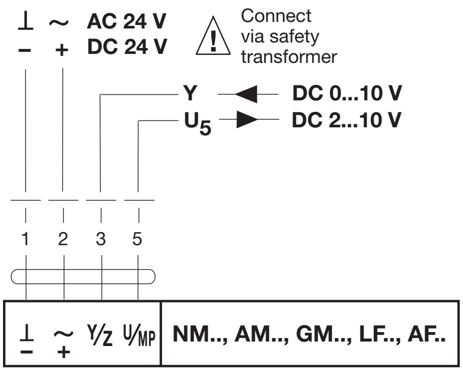


Note:
Further information on how to use the MFT-H hand-held device will be found in the «MFT-H Operating Instructions».

*Delivery deadline on request, from 2002

Wiring diagram
Modulating control DC 0…10 V

Connecting damper actuators

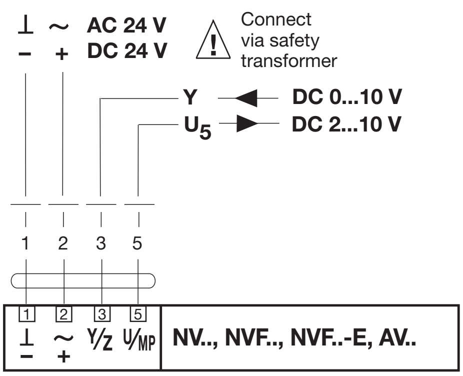


Y: Adjustable working range 0.5...32 V
U_5: Adjustable

Note:
Typical functions and functional diagrams for damper actuators with basic settings see Page 36.

Functional diagrams for damper actuators with custom-parameterised settings will be found directly adjacent to the functions.

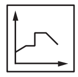
Connecting valve actuators



Y: Adjustable working range 0.5...32 V
U_5: Adjustable

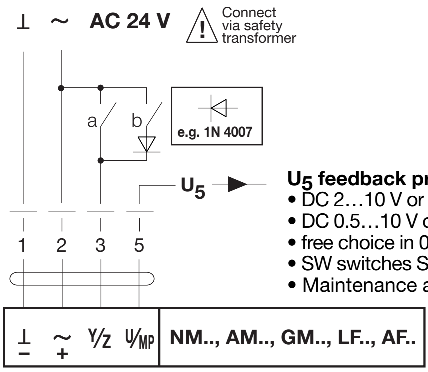
Note:
For other functional diagrams for valve actuators NV... and NVF... see Page 39

Wiring diagrams and functions



Connecting damper actuators

3-point control (can be re-parameterised with the MFT-H Parameter Assignment Device)

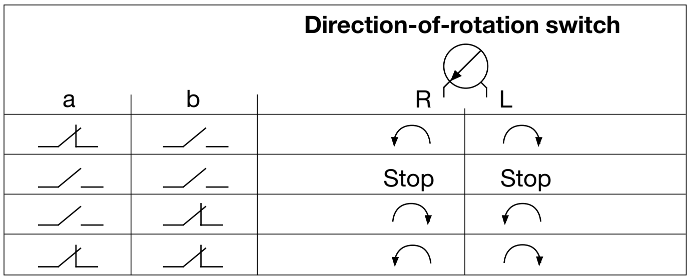


U_5 feedback programmed for:
- DC 2…10 V or
- DC 0.5…10 V or
- free choice in 0…10 V range or
- SW switches S1 and S2 or
- Maintenance and fault alarms

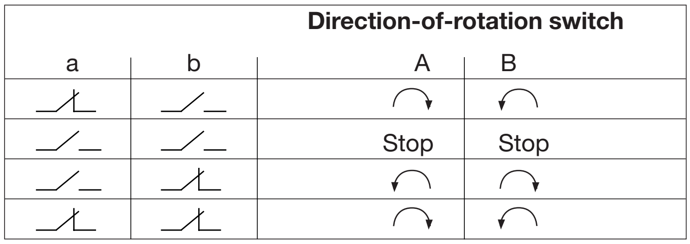
More actuators can be connected in parallel.
Take note of the rating data.

Input impedance Ri @ Y, y2 = 1.5 kΩ

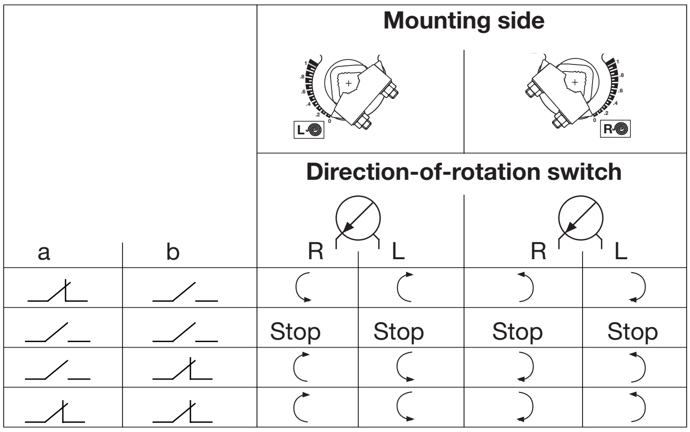
Function NM.., AM..



Function GM..



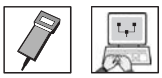
Function LF.., AF



Connecting valve actuators

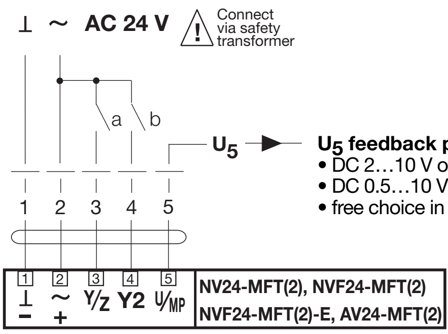
3-point control is easy to implement with a 4-wire circuit.

But remember that the actuator must be parameterised for 3-point control.



Input impedance Ri @ Y, y2 = 1.5 kΩ

Valve actuators with and without emergency control function *



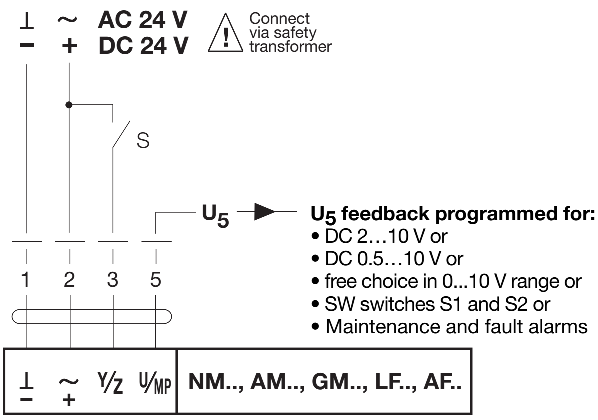
U_5 feedback programmed for:
- DC 2…10 V or
- DC 0.5…10 V or
- free choice in 0…10 V range

Control contact**		Linear actuator
a	b	spindle
Open	Open	stopped
Close	Open	extends
Open	Close	retracts
Close	Close	retracts

* Single-wire connection via terminal 3 with diode possible (see Damper Actuator diagram above)
** Slide switch S3.1/S3.2 on linear actuator in OFF position

Family / Type	Wiring diagrams and functions

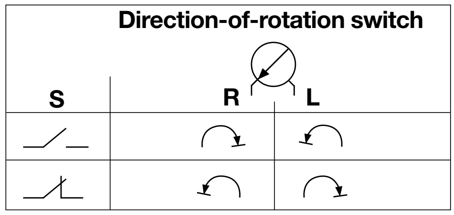
Wiring diagram for damper actuators
(custom-parameterised with the MFT-H device)



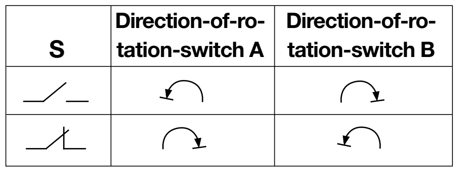
U_5 feedback programmed for:
- DC 2…10 V or
- DC 0.5…10 V or
- free choice in 0...10 V range or
- SW switches S1 and S2 or
- Maintenance and fault alarms

More actuators can be connected in parallel.
Take note of the rating data.
Input impedance Ri @ Y, y2 = 1.5 kΩ

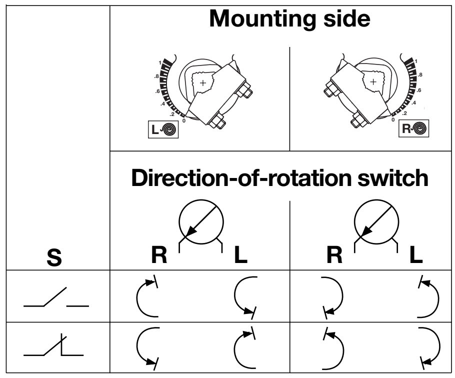
Function NM.., AM..



Function GM..



Function LF.., AF



NM

NM24-MFT(2)

AM

AM24-MFT(2)

GM

GM24-MFT(2)

LF

LF24-MFT(2)

AF

AF24-MFT(2)

NV

NV24-MFT(2)

NVF

NVF24-MFT(2)(-E)

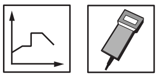
AV

AV24-MFT(2) *

Wiring diagrams for valve actuators
Override control on Page 39

*Delivery deadline on request, from 2002

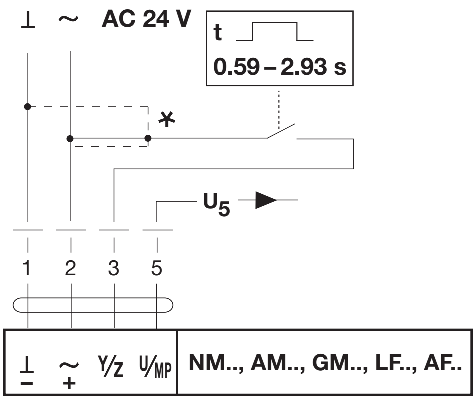
Wiring diagrams



Description of PWM control
Examples

The PWM method of control described here is most popular for the American market.

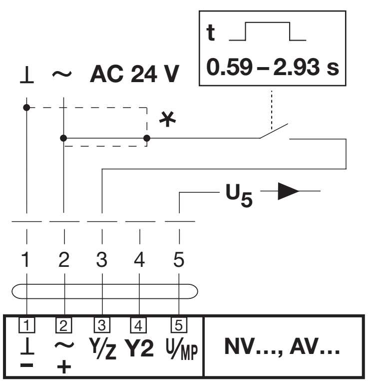
PWM wiring diagram for damper actuators



* Control by Triac (Source or Sink) also possible

Ri @ Y = 750 Ω

PWM wiring diagram for valve actuators



* Control by Triac (Source or Sink) also possible

Ri @ Y = 750 Ω

PWM control

In PWM control the actuator measures the length of the control pulse and then moves to the corresponding position.

Depending on the controller that is operating the MFT(2) actuator, various ranges of PWM can be selected at the actuator.

Selectable ranges for MFT(2) actuators for dampers and valves:

0.02 – 5 s
0.59 – 2.93 s
0.1 – 25.5 s
PWM variable from PWMmin. 0.02 s to PWMmax. 50.00 s

Examples of PWM control

(PWM range selected at the actuator: 0.59 – 2.93 s)

Example 1: 100 % angle of rotation or stroke

When a pulse of 2.93 seconds duration is sent to the actuator the latter moves to the 100 % angle-of-rotation position (if pulses of more than 2.93 seconds duration are sent to the actuator the latter will also move to the 100 % angle-of-rotation position).

Example 2: 50 % angle of rotation or stroke

When a pulse of 0.59 s + (2.93 s – 0.59 s) / 2 = 1.17 s + 0.59 s duration is sent to the actuator the latter moves to the 50 % angle-of-rotation position.

Example 3: 0 % angle of rotation or stroke

When a pulse of 0.59 s duration is sent to the actuator the latter moves to the 0 % angle-of-rotation position (if pulses of less than 0.59 s duration but more than 20 ms duration are sent to the actuator the latter will also move to the 0 % angle-of-rotation position; if the pulse is less than 20 ms the function will be undefined).

BELIMO

Family / Type
NM
NM24-MFT(2)
AM
AM24-MFT(2)
GM
GM24-MFT(2)
LF
LF24-MFT(2)
AF
AF24-MFT(2)
NV
NV24-MFT(2)
NVF
NVF24-MFT(2)(-E)
AV
AV24-MFT(2) *

*Delivery deadline on request, from 2002

The MP-Bus
Wiring diagram for control via the MP-Bus

The MP-Bus

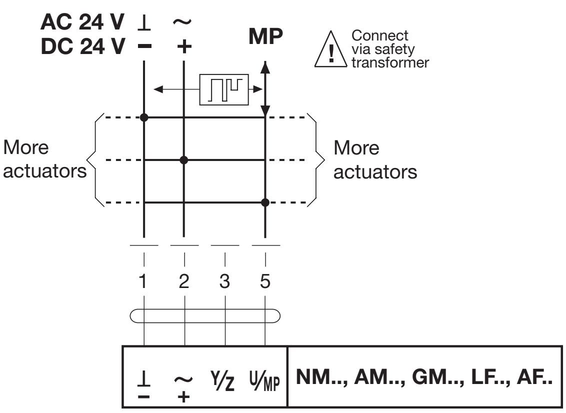
The actuators have an MP-Bus communications capability.

Up to 8 actuators can be linked together over an Belimo MP-Bus system.

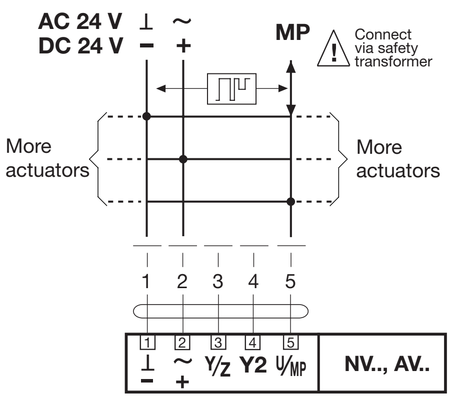
The MFT(2) actuators receive their digital control signals from a higher-level Bus-Master over the MP-Bus system and move to the specified position.

The changeover from conventional to bus operation takes place automatically as soon as an MP address (1...8) has been assigned to the MFT(2) actuator (see «MP addressing», pp. 18...19).

Wiring diagram for damper actuators



Wiring diagram for valve actuators

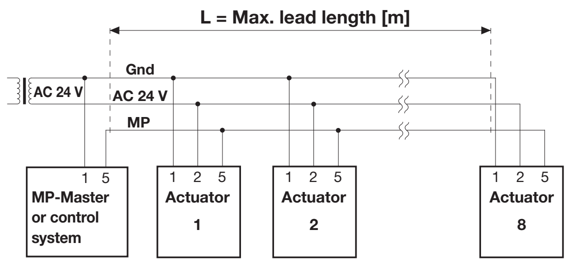


MP-Bus connection
Lead lengths for AC 24 V power via the MP-Bus

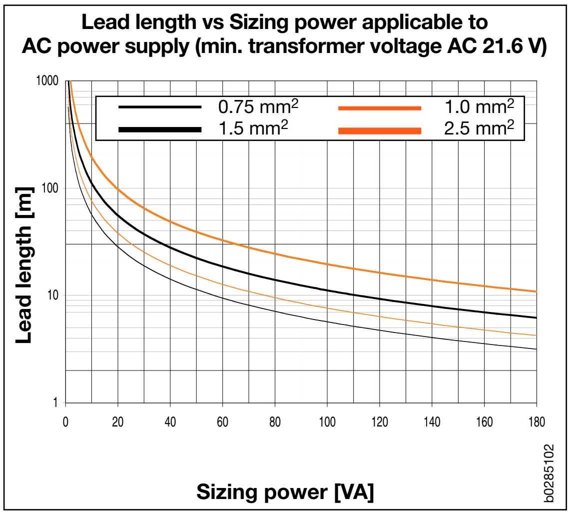
MP-Bus connection

- Facilities for connecting up to 8 MFT(2) actuators per network
- Bus linking
  - 3-core for bus power supply
  - 2-core for local power supply
- Neither special cable nor terminating resistors are needed
- The length of lead is limited (for calculation see below)
  - by the sum of the ratings of the connected MFT(2) actuators
  - by the type of power supply (AC via bus / DC via bus / AC local)

Max. lead lengths for an AC 24 V power supply (via bus system)



Total sizing power for MFT(2) actuators (VA)



⚠ With NVF24-MFT(2) actuators the sizing power must be multiplied by a factor of 2.

Calculating maximum lead lengths

The values of sizing power [VA] of the MFT(2) actuators being used must be added together so that the corresponding lead lengths can be read off from the diagram.

Example:

The following are connected to the MP-Bus: 1 in No. NM.., 1 in No. AM.., 1 in No. AF.. and 1 in No. NV..

Total sizing power:

3 VA + 5 VA + 10 VA + 5 VA = 23 VA

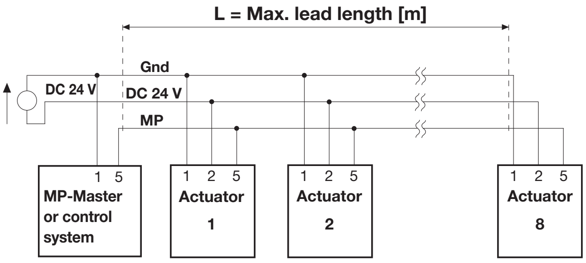
Read off the following from the family of curves:

- For cable with a core dia. 0.75 mm²: **Lead length 25 m**
- For cable with a core dia. 1.0 mm²: **Lead length 33 m**
- For cable with a core dia. 1.5 mm²: **Lead length 50 m**
- For cable with a core dia. 2.5 mm²: **Lead length 85 m**

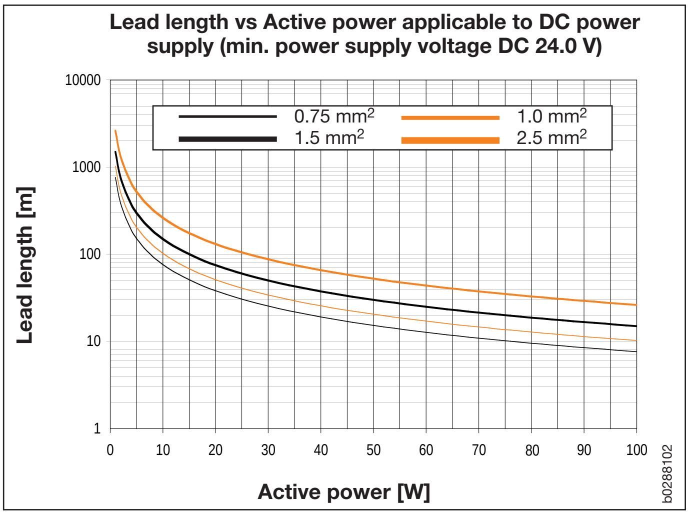
MP-Bus connection
Lead lengths for DC 24 V power via the MP-Bus

MP-Bus connection
- Facilities for connecting up to 8 MFT(2) actuators per network
- Bus linking
  - 3-core for bus power supply
  - 2-core for local power supply
- Neither special cable nor terminating resistors are needed
- The length of lead is limited (for calculation see below)
  - by the sum of the ratings of the connected MFT(2) actuators
  - by the cross sectional area of lead
  - by the type of power supply (AC via bus / DC via bus / AC local)

Maximum lead lengths for a DC 24 V power supply (via bus system)



Total sizing power for MFT(2) actuators (W)



Lead length vs Active power applicable to DC power supply (minimum voltage DC 24 V)

Calculating maximum lead lengths
The values of power consumption [W] of the MFT(2) actuators being used must be added together so that the corresponding lead lengths can be read off from the diagram.

Example:
The following are connected to the MP-Bus: 1 in No. NM.., 1 in No. AM.., 1 in No. AF.. and 1 in No. NV..

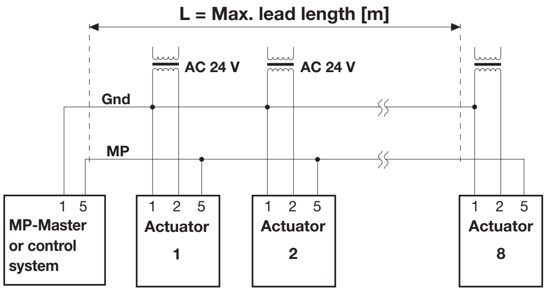
Total sizing power:
1.3 W + 2.5 W + 6.0 W + 3.0 W = 12.8 W

Read off the following from the family of curves:
- For cable with a core dia. 0.75 mm²: **Lead length 60 m**
- For cable with a core dia. 1.0 mm²: **Lead length 80 m**
- For cable with a core dia. 1.5 mm²: **Lead length 115 m**
- For cable with a core dia. 2.5 mm²: **Lead length 200 m**

MP-Bus connection
Lead lengths for an AC 24 V power supply (local)

MP-Bus connection
- Facilities for connecting up to 8 MFT(2) actuators per network
- Bus linking
  - 3-core for bus power supply
  - 2-core for local power supply
- Neither special cable nor terminating resistors are needed

Maximum lead lengths for an AC 24 V power supply (local)



When the actuators are being supplied locally at AC 24 V from a separate transformer the lead lengths can be increased very substantially. The lead lengths are as listed in the table regardless of the power ratings of the connected actuators.

Core dia. [mm²]	L = Max. lead length [m]
0.75	800
1.0	
1.5	
2.5	

Family Type	MP-Bus: Connecting passive sensors

NM

NM24-MFT2

AM

AM24-MFT2

GM

GM24-MFT2

LF

LF24-MFT2

AF

AF24-MFT2

NV

NV24-MFT2

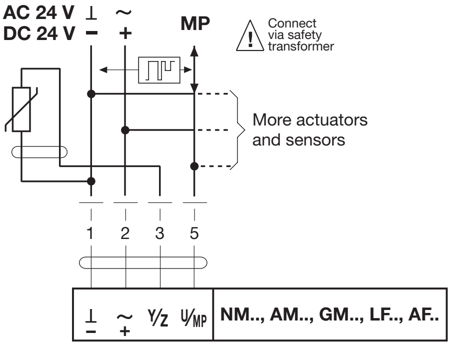
NVF

NVF24-MFT2 (-E)

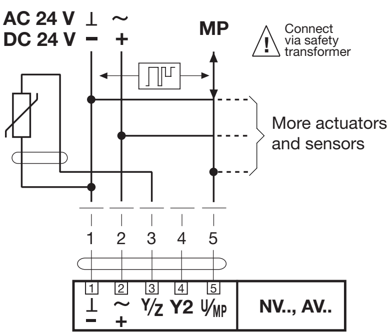
AV

AV24-MFT2 *

Wiring diagram for damper actuators



Wiring diagram for valve actuators



*Delivery deadline on request, from 2002

Connecting sensors for MP-Bus operation

- Each MFT(2) actuator has a connection facility for 1 sensor (passive/active sensor or switching contact).
- The MFT(2) actuator serves as an analogue/digital converter for transferring the sensor signal to the higher-level system over the MP-Bus.
- The higher-level system must know the physical address (i.e. which sensor on which actuator) and also be able to interpret the corresponding sensor signal.
- Sensors should be connected by means of a separate wire whenever possible or at least the ground wire of the sensor should be run separately from the ground wire of the power supply for as great a distance as possible (in order to avoid equalising currents).
- In the case of passive sensors the cross sectional area of the connecting wire should be as large as possible (1 to 1.5 mm²) because the resistance of the wire affects the accuracy of measurement.

Passive sensors suitable for connection

Sensor type	Measurable temperature ranges
Ni1000	–28 °C…98 °C
Pt1000	–35 °C…155 °C
NTC (1 kΩ–10 kΩ @ 25 °C)	according to type –10 ° C…160 °C
Measuring ranges of the sensor input (3) when measuring resistance values	
Sensor type	**Measuring ranges**
Ni1000	850 Ω–1600 Ω
Pt1000	850 Ω–1600 Ω
NTC sensors	100 Ω–60 kΩ

Measuring ranges and accuracy of the measuring system when connecting passive sensors to the sensor input (3)

1. Pt1000 or Ni1000

Measuring range: 850–1600 Ω	
Measuring tolerance, abs. [%]	Resolution (whole number)
±0.3 %	1 Ω
Example: Pt1000 @ 0 °C = 1000 Ω Measuring tolerance = ±3 Ω or ±0.5 °K	

2. NTC

Measuring range: 100 Ω–60 kΩ			
Measuring tolerance, abs. [%] corresponding to Ω measuring range		Resolution	Example: NTC 2.2 kΩ measured temperature
200–300 Ω	±5	1 Ω	±2 °K @ 85 °C
301–600 Ω	±2		±0.6 °K @ 60 °C
601–1700 Ω	±1		±0.25 °K @ 32 °C
1701–5000 Ω	±2		±0.5 °K @ 5 °C
5001–10000 Ω	±5		±1 °K @ –10 °C
10001–20000 Ω	±10		±1.5 °K @ –25 °C
20001–50000 Ω	±25		±4 °K @ –40 °C

MP-Bus: Connecting active sensors

Connecting sensors for MP-Bus operation (applicable to actuators for both dampers and valves)

- Each MFT(2) actuator has a connection facility for 1 sensor (passive/active sensor or switching contact).
- The MFT(2) actuator serves as an analogue/digital converter for transferring the sensor signal to the higher-level system over the MP-Bus.
- The higher-level system must know the physical address (i.e. which sensor on which actuator) and also be able to interpret the corresponding sensor signal.
- Sensors should be connected by means of a separate wire whenever possible or at least the ground wire of the sensor should be run separately from the ground wire of the power supply for as great a distance as possible (in order to avoid equalising currents).
- In the case of passive sensors the cross sectional area of the connecting wire should be as large as possible (1 to 1.5 mm2) because the resistance of the wire affects the accuracy of measurement.

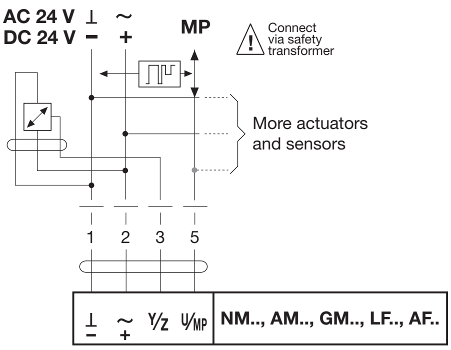
What are active sensors?

Sensors for temperature, humidity, etc. with an output of DC 0 to 32 V

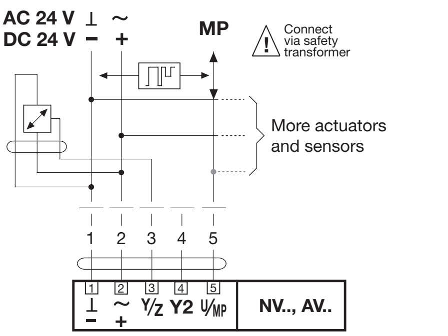
Resolution

Typically 30 mV

Wiring diagram for active sensors on damper actuators



Wiring diagram for active sensors on valve actuators



MP-Bus: Connecting external switches, e.g. pressure monitors

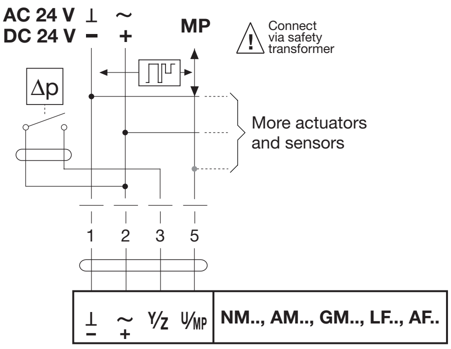
Requirements for switching contacts

A switching contact must be able to make and break a current of 16 mA @ 24 V.

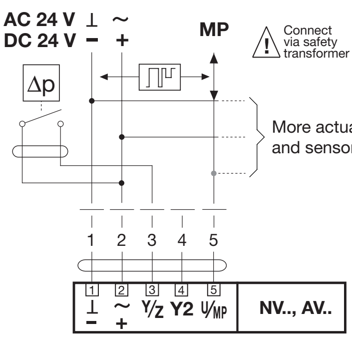
Note:

The MFT(2) actuators must be parameterised with >= 0.6 V as the start point of the working range.

Wiring diagram for external switching contacts on damper actuators



Wiring diagram for external switching contacts on valve actuators

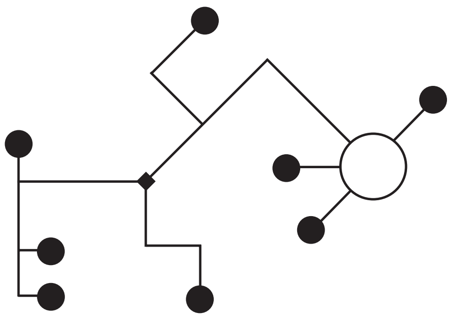


Network topology

Applicable to actuators for both dampers and valves

No restrictions

There are no restrictions on network topology (star, ring, tree or mixed formats are permissible).



(up to 8 actuators)

Family

Type

NM

NM24-MFT(2)

AM

AM24-MFT(2)

GM

GM24-MFT(2)

LF

LF24-MFT(2)

AF

AF24-MFT(2)

NV

NV24-MFT(2)

NVF

NVF24-MFT(2)(-E)

AV

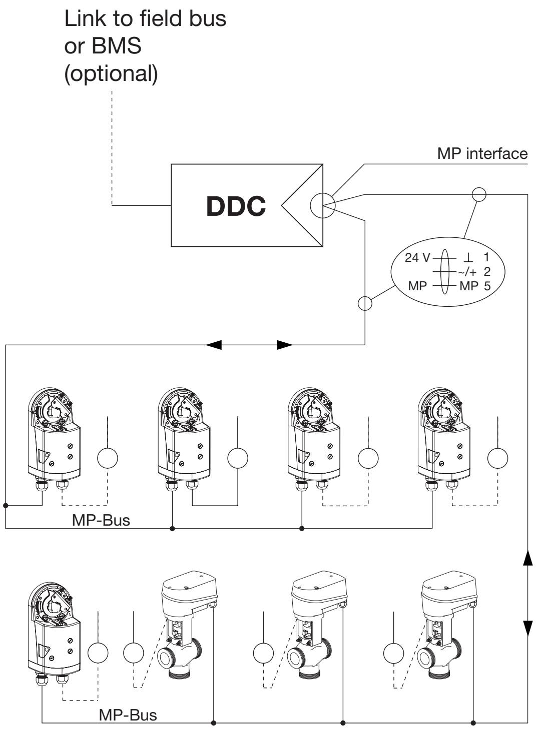
AV24-MFT(2) *

MP-Bus and co-operation nodes

Applicable to actuators for both dampers and valves

Co-operation nodes

Belimo will be happy to supply any manufacturers of digital controllers (DDC, SPC) who would like to integrate the MP-Bus protocol into their products with a technical specification of the system. The controllers will then be able to communicate directly with MFT(2) actuators.



Connecting sensors

Either an active sensor or a passive sensor can be connected to each actuator.

Linking to a field bus

The controller can be linked to a field bus (e.g. LON) provided it is equipped with a suitable interface.

*Delivery deadline on request, from 2002

Other makes with MP interface

Applicable to actuators for both dampers and valves

DDC or SPC systems with an MP interface

Maker: *SAIA-Burges*
Types: PDC1, PDC2
MP-module: PDC2.T500 for 2 x 8 MFT(2) actuators and sensors

Linking to a LON-Bus through a UK24LON unit

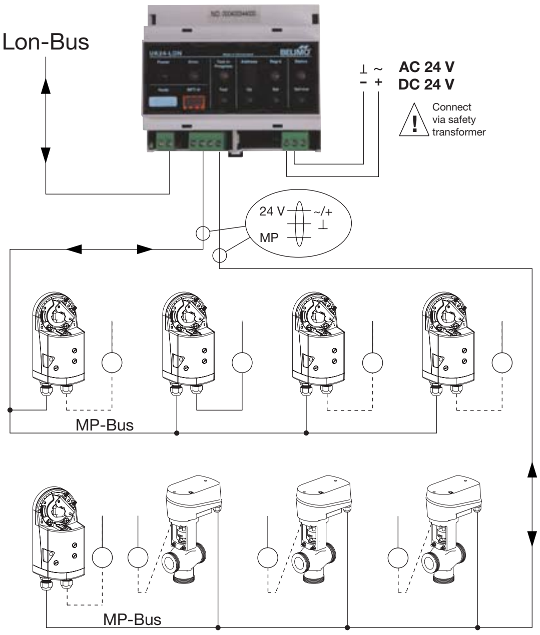
Applicable to actuators for both dampers and valves

The UK24LON unit

The purpose of the Belimo UK24LON unit, which has been approved by LonMark, is to link a Belimo MP-Bus to a LON-Bus. The UK24LON unit incorporates an FTT-10A Transceiver.

Up to 8 actuators can be connected to the MP-Bus side.

LONMARK®



Connecting sensors

Either an active sensor or a passive sensor can be connected to each actuator. This allows the analogue signal from the sensor to be digitised very simply by means of the Belimo actuator so that it can be passed on to the LON-Bus via the UK24LON unit.

Further information

Further information on integrating systems into a LON-Bus can be found in the UK24LON product documentation.

MP-Bus cycle times

Applicable to actuators for both dampers and valves

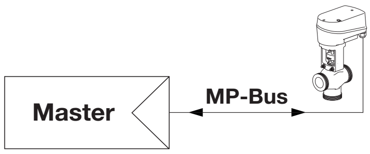
Communication time

Each command that is transmitted over the bus takes an average of ca. 150 milliseconds (a command always comprises an instruction and a response).

1. Example with one MFT(2) actuator

- The Master sends a set value to the MFT(2) actuator (1st command).
- The Master reads out the actual value from the MFT(2) actuator (2nd command).

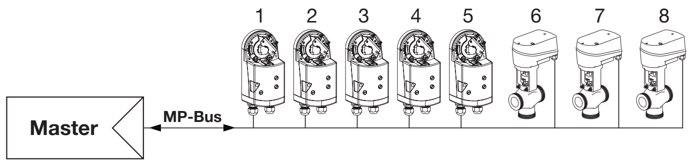
Therefore, the whole process of communication lasts for 2 commands of 150 ms each = **ca. 300 ms**.



2. Example with eight MFT(2) actuators

- The Master sends a set value to each of the 1 to 8 MFT(2) actuators (No. of commands: 8).
- The Master reads out the actual values from the eight MFT(2) actuators (No. of commands: 8).

Therefore, the whole process of communication lasts for 16 commands of 150 ms each = **ca. 2.4 s**.



Notes

Algorithm

The algorithm for the cycle must be specified by the maker of the digital controller (DDC).

UK24LON cycle times

When MFT(2) actuators are used in conjunction with a Belimo UK24LON unit the corresponding cycle times will be found listed in the product data sheet.

Family

Type

NM

NM24-MFT(2)

AM

AM24-MFT(2)

GM

GM24-MFT(2)

LF

LF24-MFT(2)

AF

AF24-MFT(2)

NV

NV24-MFT(2)

NVF

NVF24-MFT(2)(-E)

AV

AV24-MFT(2) *

MP-Bus addressing, semi-automatic

BUS

Applicable to actuators for both dampers and valves

One Bus-Master (e.g. DDC controller) can communicate with up to 8 Slaves (MFT(2) actuators) over an MP-Bus. Each node in the bus system must be clearly identifiable. Therefore, it is essential for each Slave to have its own address.

MP-Bus addressing, semi-automatic with acknowledgement

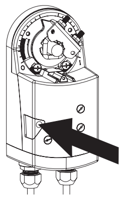
Procedure

1. Set the required MP address 1 to 8 at the Bus-Master (UK24LON).
2. Set the Bus-Master to the ready position by initiating the appropriate function (UK24LON ‘Set’ button).
3. Make the appropriate acknowledgement at the actuator (see diagrams). The MP address that was set at the Bus-Master has now been assigned to the MFT(2) actuator.

Acknowledgement with NM.., AM.., GM..

Procedure

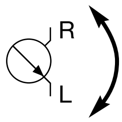
Press the manual button once.



Acknowledgement with LF.., AF..

Procedure

Move the L/R switch back and forth once (in less than 5 seconds)

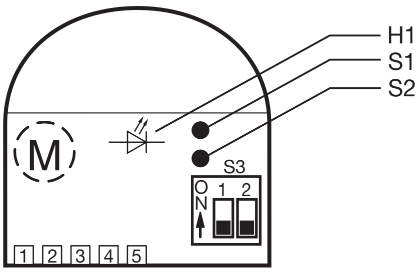


Acknowledgement with NV.., NVF..(-E), AV..

Procedure

Press the S2 button once.

Note:
If the H1 light flashes (alternately red/green) it means that you must acknowledge with the S2 button.



*Delivery deadline on request, from 2002

MP-Bus addressing by serial number

BUS

Applicable to actuators for both dampers and valves

One Bus-Master (e.g. DDC controller) can communicate with up to 8 Slaves (MFT(2) actuators) over an MP-Bus. Each node in the bus system must be clearly identifiable. Therefore, it is essential for each Slave to have its own address.

MP-Bus addressing by serial number

Individual serial numbers

Attached to each actuator when it is delivered is a label bearing its individual serial number.

Example: 09939-31234-064-008

Key

09939	Year and week
31234	Day of number
064	Family
008	Testing station

Archiving the serial number for addressing

A second detachable label bearing the identical serial number is also attached to the actuator for the following purpose:

When the actuator has been installed in a specific position in the system this second label can be detached from the actuator and stuck on to the system plan in the corresponding position. This allows each individual actuator to be traced when necessary.

When the system is being commissioned the PC-Tool can now be used to communicate with the MFT(2) actuator by means of its serial number; the MP address (1 to 8) can be assigned in this way.

BELIMO

Family / Type	Basic positions, factory setting	Basic positions, parameterisable

NM

NM24-MFT(2)

AM

AM24-MFT(2)

GM

GM24-MFT(2)

Basic positions, factory setting

Positions with NM.., AM.., GM..
At the first power-up, i.e. during initial commissioning or after the pushbutton has been pressed, the actuator moves to the basic position.

After this, the actuator moves to the position specified by the control signal.

Pos. D-of-R switch		Basic position
L	Y = 0 ↶	ccw ↶ End-stop left
R	Y = 0 ↷	↷ cw End-stop right

Basic positions, parameterisable

Positions with NM.., AM.., GM..
Can be inverted from the factory setting.

LF

LF24-MFT(2)

AF

AF24-MFT(2)

Basic positions, factory setting

Positions with LF.., AF..
After power-up, the LF24-MFT(2) and the AF24-MFT(2) automatically acquire their safe positions (zero initialising).

This process – while the actuator is stationary – takes ca. 15 seconds.

Basic positions, parameterisable

Positions with LF.., AF..
See Basic positions

NV

NV24-MFT(2)

NVF

NVF24-MFT(2)(-E)

AV

AV24-MFT(2) *

Basic positions, factory setting

Positions with NV.., NVF..(-E), AV..
See Adaption (overleaf).

Basic positions, parameterisable

Positions with NV.., NVF..(-E), AV..
See Adaption (overleaf).

*Delivery deadline on request, from 2002

Angle-of-rotation or stroke adaption, factory setting

Angle-of-rotation adaption for damper actuators

Adaption is **not** automatic!

Angle-of-rotation or stroke adaption, parameterisable

Angle-of-rotation adaption for damper actuators

Automatic adaption can be started with the PC-Tool or the MFT manual parameter assignment device. The mechanical angle-of-rotation (upper and lower end-stops) is acquired and stored in the microcomputer. The running time and the working range are adapted to the control range that is preset with MIN and MAX. The U5 measuring signal corresponds to the effective mechanical angle-of-rotation.

The function can also be triggered manually:

– NM, AM, GM: press the manual button twice

– LF, AF: move the switch from L to R and back again within 5 seconds

Stroke adaption for valve actuators (valves with 2 mechanical end-stops)

At the first power-up the stroke is adapted automatically. The available stroke (between the two mechanical end-stops of the valve) is acquired as the 100% value and stored in the micro-computer. The control signal and the running time are then adapted to suit this 100 % value.

The function can also be triggered by pressing the S2 button (under the lid of the housing).

Stroke adaption for valve actuators (with 2 end-stops)

Adaption can be started with the PC-Tool or the MFT manual parameter assignment device.

Fault alarms can only be reset with the S2 button.

Note:
In the case of valves without a second mechanical end-stop the effective value of stroke can be stored in the software; the S2 adaption button is inoperative.

(However, a test run with synchronisation is performed at the closing point).

BELIMO

Family / Type	Working range DC 2…10 V	Working range DC variable	Feedback U5 as modulating DC measuring signal U

Family

Type

NM

NM24-MFT(2)

AM

AM24-MFT(2)

GM

GM24-MFT(2)

LF

LF24-MFT(2)

AF

AF24-MFT(2)

NV

NV24-MFT(2)

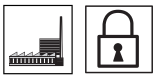
NVF

NVF24-MFT(2)(-E)

AV

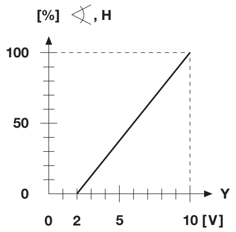
AV24-MFT(2) *

Working range DC 2…10 V



Damper and valve actuators

Diagram

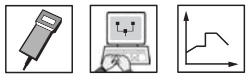


Legend:

∢, H = Angle-of-rotation or stroke

*Delivery deadline on request, from 2002

Working range DC variable



Damper and valve actuators

Adjustable values

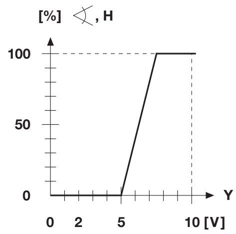
Start point: DC 0.5…30 V
End point: DC 2.5…32 V

Note:

The end point must be at least 2 V above the start point.

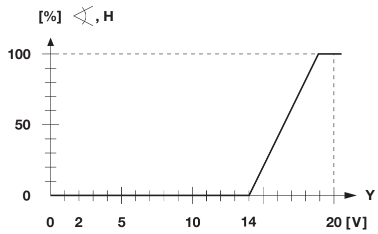
Example 1

Preset working range DC 5...7.5 V



Example 2

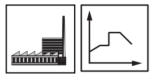
Preset working range DC 14...19 V



Legend:

∢, H = Angle-of-rotation or stroke

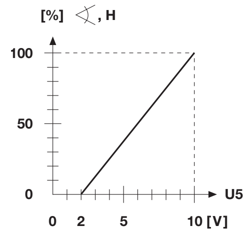
Feedback U5 as modulating DC measuring signal U

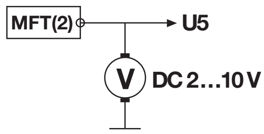


Damper and valve actuators

Diagram

U5 = DC 2…10 V @ 0.5 mA





Legend:

∢ = Angle-of-rotation
H = Nominal stroke

U5 as modulating DC measuring signal U, variable

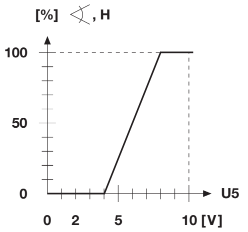
Damper and valve actuators

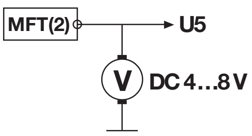
Adjustable values
Start point: DC 0.5...8 V
End point: DC 2.5...10 V

Note:

The end point must be at least 2 V above the start point.

Example
Preset working range DC 4...8 V





Legend:
∢ = Angle-of-rotation
H = Nominal stroke

U5 as maintenance / fault alarm

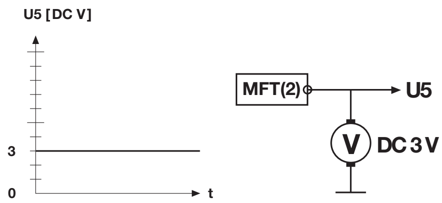
Applicable to actuators for both dampers and valves

Definable criteria
The following criteria providing an output at U5 for a maintenance or alarm signal can be defined:

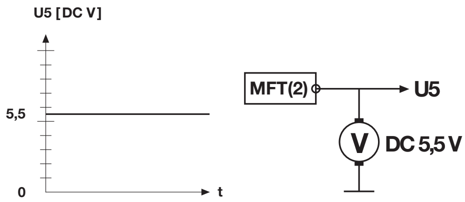
- **Stop & Go-ratio**
  Actuator hunting (unstable system) can be selected for MFT(2) actuators NM, AM, GM, LF, AF
- **Mechanical overload** (set position not reached, actuator stationary) can be selected for all MFT(2) actuators
- **Actuating travel** (mechanical position changed 10%) can be selected for all MFT(2) actuators

Signals:
According to whether **Maintenance** or **Fault** has been defined from the above criteria, U5 outputs the appropriate signal when the event occurs.

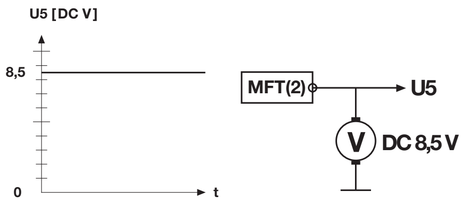
Output level for normal operation
(no maintenance or fault alarm signal)



Output level for maintenance alarm



Output level for fault alarm



⚠ **Note on damper actuators:**
For these functions, angle-of-rotation adaption must be implemented (see Page 21) when the angle-of-rotation is mechanically limited (< 95°).

⚠ **Note on valve actuators:**
When a fault alarm has been activated the red LED under the lid of the housing also lights up.

(Faults can only be reset by re-adapting with S2)

U5 as soft-switch

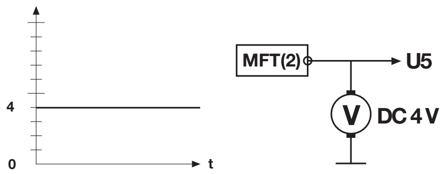
Damper and valve actuators

Assignment of softswitches
Softswitches can also be assigned to U5, in which case the U5 signal is converted to 3 different voltage levels; this signals the status of the 2 switches that can be selected (S1, S2).

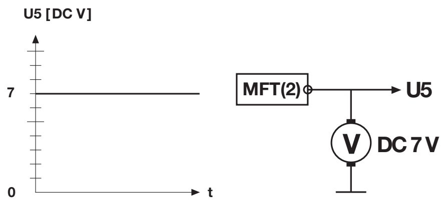
S1 and S2 can be adjusted between 1 % and 99 % angle-of-rotation (or stroke in the case of a linear actuator).

Switching levels: see following examples.

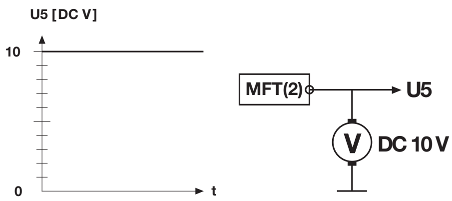
Example 1: Actuator position less than preset value of S1



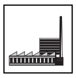
Example 2: Actuator position greater than preset value of S1 and less than value of S2



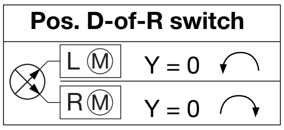
Example 3: Actuator position greater than preset value of S2



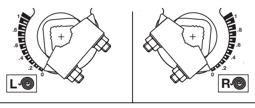
⚠ **The value of S1 must be at least 10 % less than that of S2**

Family / Type	Direction-of-rotation when Y = 0	Direction-of-rotation, reversible
		
NM  NM24-MFT(2)	Applicable to NM.., AM.., GM..	●
AM  AM24-MFT(2)		●
GM  GM24-MFT(2)		●
LF  LF24-MFT(2)	Applicable to LF.., AF..	●
AF  AF24-MFT(2)		●
NV  NV24-MFT(2)		
NVF  NVF24-MFT(2)(-E)		
AV  AV24-MFT(2) *		

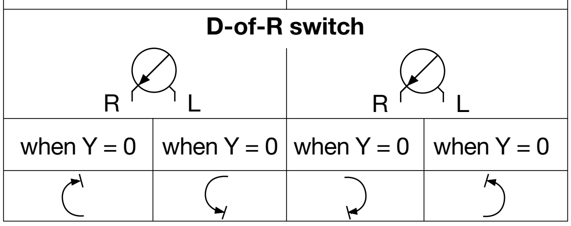
Pos. D-of-R switch



Mounting side



D-of-R switch



*Delivery deadline on request, from 2002

BELIMO

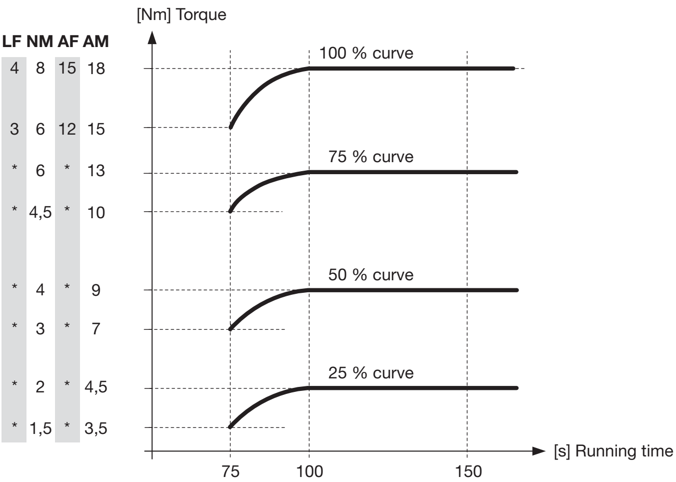
Family / Type	Running time, factory setting	Changing the running time
NM  **NM24-MFT(2)**	**Factory setting for NM.., AM.., GM..** 150 s	**Note: Applicable to all actuators** When the running time is changed the torque / actuating force and sound power level also change. Refer to the function curves on the next page. **Possible settings for:** NM.., AM.. 75…300 s GM.. 120…300 s
AM  **AM24-MFT(2)**		
GM  **GM24-MFT(2)**		
LF  **LF24-MFT(2)**	**Factory setting for LF..** Motor: 150 s Spring return: ≈20 s @ –20…50 °C max. 60 s @ –30 °C	**Possible settings for LF.., AF..** 75…300 s
AF  **AF24-MFT(2)**	**Factory setting for AF..** Motor: 150 s Spring return: ≈ 20 s	
NV  **NV24-MFT(2)**	**Factory setting for NV.., NVF..(-E)** 150 s	**Possible settings for NV.., NVF..(-E)** 55 (95)…1200 (2200) s for 10(20) mm stroke
NVF  **NVF24-MFT(2)(-E)**		
AV  **AV24-MFT(2)** *	**Factory setting for AV..** 320 s	**Possible settings for AV..** 170…800 s

*Delivery deadline on request, from 2002

Torque / actuating force function when changing the running time

Applicable to damper actuators

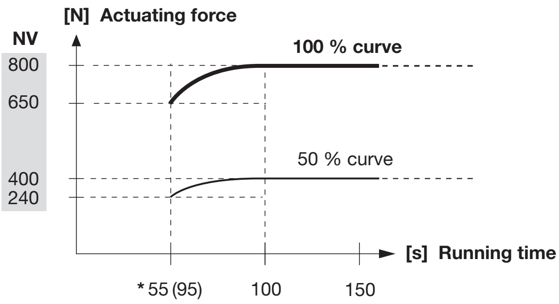
Torque function when changing the running time



* AF and LF: Torque cannot be reduced

Applicable to valve actuators

Actuating force function when changing the running time

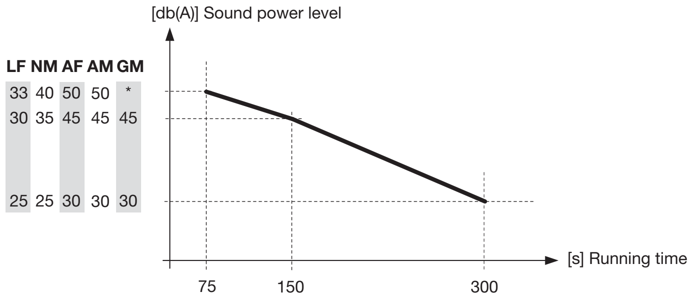


* for 10(20) mm stroke

Sound power level function when changing the running time

Applicable to damper actuators

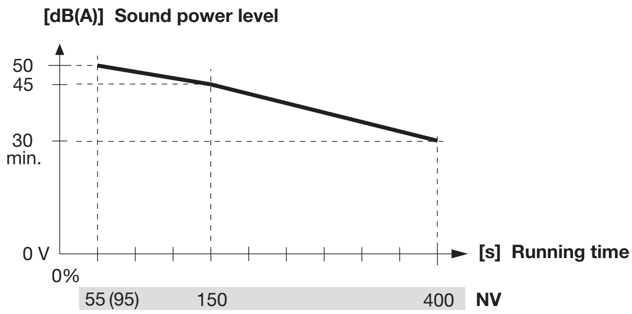
Sound power level function when changing the running time



* GM: Running time can be changed 120...300 s

Applicable to valve actuators

Sound power level function when changing the running time



Family / Type	Blocking torque	Torque, factory setting	Torque, adjustable	Blocking force
NM  NM24-MFT(2)	8 Nm	min. 8 Nm	Applicable to NM.., AM.., GM.. Torque can be reduced to 25 %, 50 %, 75 %	
AM  AM24-MFT(2)	15 Nm	min. 18 Nm		
GM  GM24-MFT(2)	30 Nm	min. 30 Nm		
LF  LF24-MFT(2)	4 Nm	Motor and spring return min. 4 Nm	Applicable to LF.., AF.. Torque **cannot** be reduced	
AF  AF24-MFT(2)	15 Nm	Motor and spring return min. 15 Nm		
NV  NV24-MFT(2)				
NVF  NVF24-MFT(2)(-E)				800 N
AV  AV24-MFT(2) *				2000 N

*Delivery deadline on request, from 2002

Actuating force, factory setting	Actuating force, adjustable	Angle-of-rotation	Electronic angle-of-rotation limiting
		max. 95 ° mechanically limited 20…100 % ∢	Applicable to damper actuators Electronic angle-of-rotation limiting see Page 31
		max. 95 ° mechanically limited 35…100 % ∢	
		max. 95 ° angle-of-rotation limiting possible with accessory ZDB-GM	
		max. 95 ° mechanically limited 37…100 % ∢ or with accessory ZDB-LF	
		max. 95 ° angle-of-rotation limiting possible with accessory ZDB-AF	
Closing force 1000 N Blocking force 800 N	Can be reduced to 25 %, 50 %, 75 %		
Motor and spring return 800 N	Actuating force and spring return **cannot** be reduced!		
2000 N	Can be reduced to 25 %, 50 %, 75 %		

Family / Type	Override control and electronic angle-of-rotation limiting

NM

NM24-MFT(2)

AM

AM24-MFT(2)

GM

GM24-MFT(2)

LF

LF24-MFT(2)

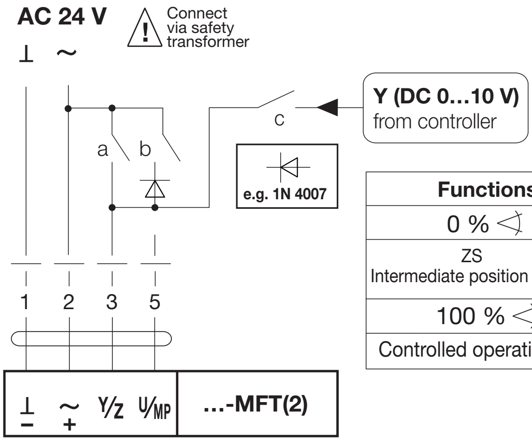
AF

AF24-MFT(2)

Override control
(referred to the full mechanical angle of rotation of 95°)

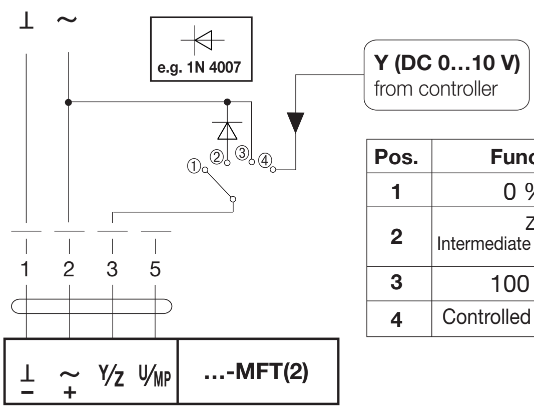
MAX	(Max. position)	= 100 %
MIN	(Min. position)	= 0 %
ZS	(intermediate position)	= 50 %

Diagram of override control AC 24 V (with relay contacts)



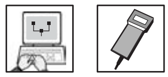
Functions	a	b	c
0 %	_/ _	_/ _	_/ _
ZS Intermediate position 50 %	_/ _	_/_	_/ _
100 %	_/_	_/ _	_/ _
Controlled operation as Y	_/ _	_/ _	_/_

Diagram of override control AC 24 V (with rotary switch)



Pos.	Functions
1	0 %
2	ZS Intermediate position 50 %
3	100 %
4	Controlled operation as Y

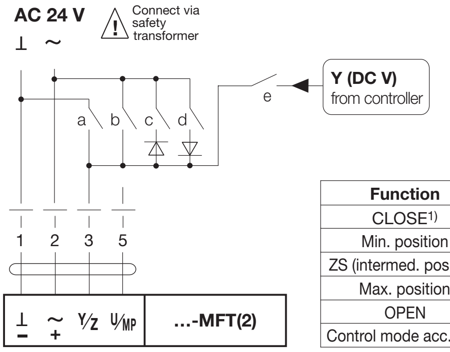
Override control and electronic angle-of-rotation limiting



Position	**Selectable**
MAX (End of operating range)	0…100 % from angle of rotation
MIN (Beginning of operating range)	0…100 % from MAX
ZS (Intermediate position, 0 % = MIN, 100 % = MAX)	0…100 % from control range (MIN…MAX)

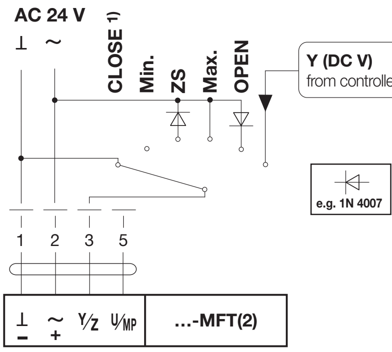
Wiring diagram for customised parameter override control with AC 24 V

With relay contacts



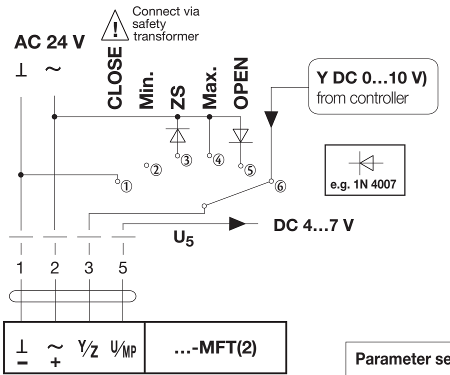
Function	a	b	c	d	e
CLOSE[1]	⊥	/	/	/	/
Min. position	/	/	/	/	/
ZS (intermed. position)	/	/	⊥	/	/
Max. position	/	⊥	/	/	/
OPEN	/	/	/	⊥	/
Control mode acc. to Y	/	/	/	/	⊥

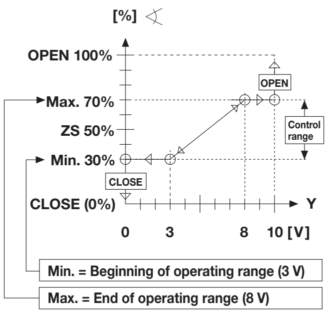
With rotary switch



[1] **Note! The function needs the beginning of the operating range to be set to a minimum of 0.6 V in order to be effective.**

Example of override control and electronic angle of rotation limiting





Description

- In the control mode (rotary switch Pos. ⑥) the actuator runs with limiting through Min. and Max. (example: 30 %....70 %) in the control range. Note: When the Y-signal is < 0.2 V, the actuator runs in the override position CLOSE.
- When the rotary switch is set to positions ①–⑤, the actuator runs to the required position according to the appropriate override command.

Parameter settings:

Operating range	Feedback signal U5
Start = DC 3 V	Start = DC 4 V
Finish = DC 8 V	Finish = DC 7 V

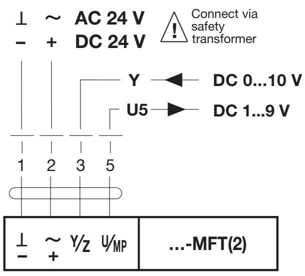
Min. (min. position)	Max. (max. position)	ZS (intermed. position)
43 % Max. (≙ 30 % ∢)	70 % ∢	50 %

Note:
The intermediate position ZS is referred to the control range set with Min. and Max.
(0 % ZS = Min. / 100 % ZS = Max.)

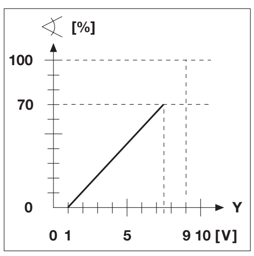
Example of feedback signal U5 with mechanically-limited angle of rotation (with and without angle of rotation setting)

Parameter settings:

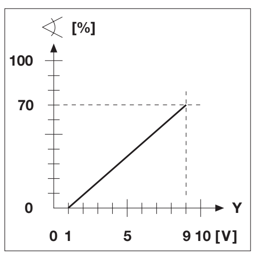
Control signal	Feedback signal U5	Angle of rotation mechanically limited by limit stops
DC 0…10 V	Start = DC 1 V Finish = DC 9 V	at 70 % ∢



a) Graph **without** angle of rotation setting



b) Graph **with** angle of rotation setting



Family / Type	Damper actuators with basic values: Functional examples and diagrams

NM

NM24-MFT(2)

AM

AM24-MFT(2)

GM

GM24-MFT(2)

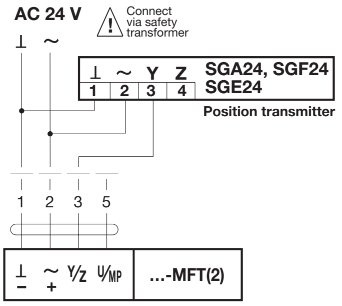
LF

LF24-MFT(2)

AF

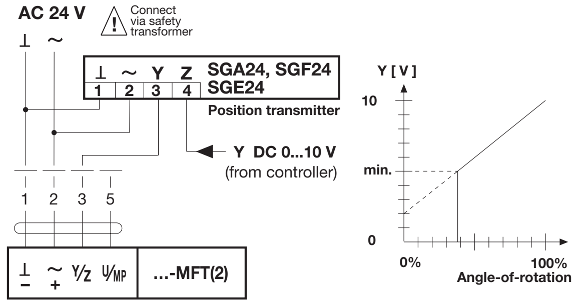
AF24-MFT(2)

Remote control 0 to 100%



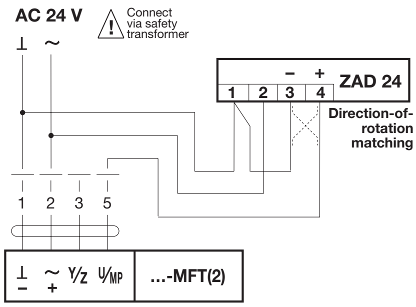
Up to 10 more actuators can be connected in parallel

Minimum limiting

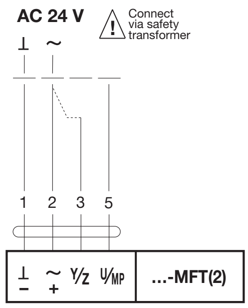


Up to 10 more actuators can be connected in parallel

Position indication



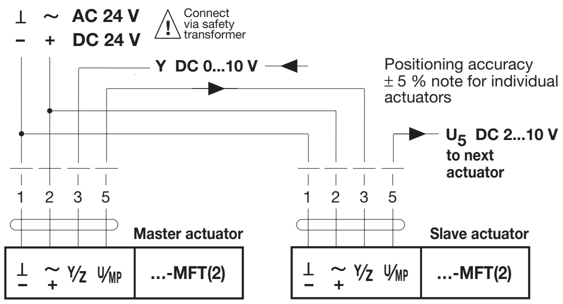
Functional check



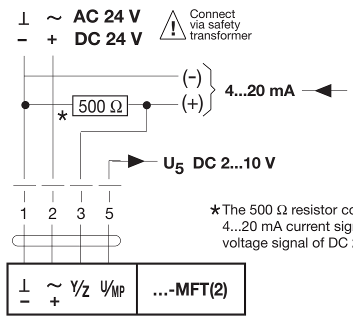
Procedure

- Apply AC 24 V to terminals 1 and 2
- Disconnect terminal 3:
  - direction-of-rotation "**L**": Aactuator rotates ccw
  - direction-of-rotation "**R**": actuator rotates cw
- Short-circuit terminals 2 and 3:
  - actuator runs ccw

Follow-up control (position-sensitive)



4 to 20 mA control via external resistance



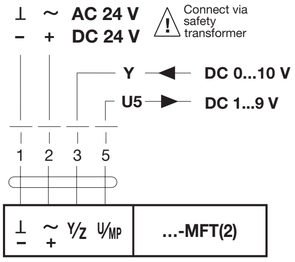
*The 500 Ω resistor converts the 4...20 mA current signal to a voltage signal of DC 2...10 V.

Custom-parameterised damper actuators: Functional examples and diagrams

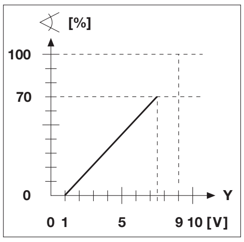
Feedback signal U5 with mechanically-limited angle of rotation (with and without angle of rotation setting)

Parameter settings:

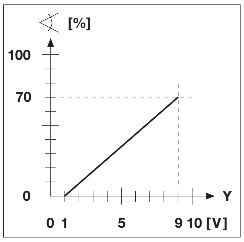
Control signal	Feedback signal U5	Angle of rotation mechanically limited by limit stops
DC 0…10 V	Start = DC 1 V Finish = DC 9 V	at 70 % ∢



a) Graph **without** angle of rotation setting



b) Graph **with** angle of rotation setting



Family / Type	Simple mounting	Mechanical position indication

Family

Type

NM

NM24-MFT(2)

AM

AM24-MFT(2)

GM

GM24-MFT(2)

LF

LF24-MFT(2)

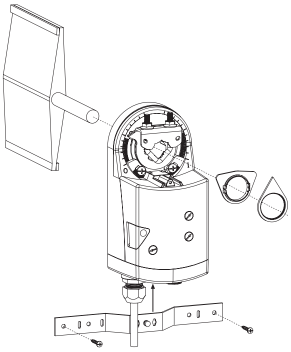
AF

AF24-MFT(2)

Simple mounting

Applicable to damper actuators

Direct mounting
Simple direct mounting on the damper spindle by means of a universal clamp. An anti-rotation device is included to prevent the unit from twisting.

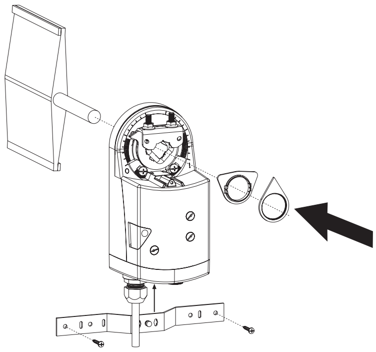


Example: AM24-MFT(2)

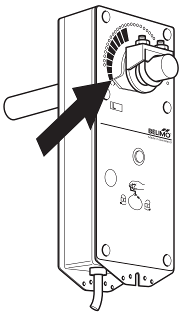
Mechanical position indication

Applicable to damper actuators

Position indication
From the spindle clamp.



Example: AM24-MFT(2)



Example: AF24-MFT(2)

NV

NV24-MFT(2)

NVF

NVF24-MFT(2)(-E)

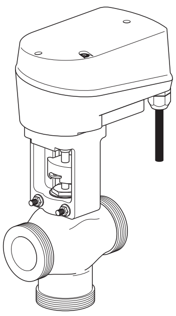
AV

AV24-MFT(2) *

Simple mounting

Applicable to valve actuators

Mounting
Simple mounting on the neck of the valve. Easy connection of valve stem and actuator spindle (no tools needed).



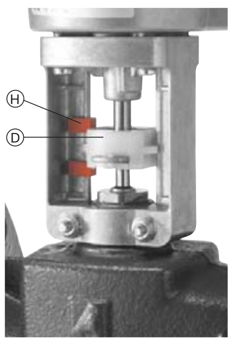
Example: NV24-MFT(2)

*Delivery deadline on request, from 2002

Mechanical position indication

Applicable to valve actuators

Ascertaining the valve position
The position of the valve can be ascertained by means of the position indicator (D) and the two position followers (H). During commissioning, the position indicator positions the followers automatically according to the amount of valve stroke that has been executed.



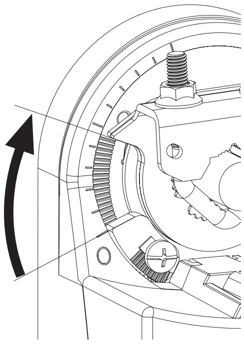
Example: NV24-MFT(2)

Mechanical position limiting

Applicable to damper actuators

Setting the angle-of-rotation
The angle-of-rotation can be set by means of the built-in mechanical end-stops.

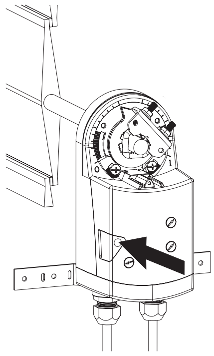
In the case of the GM24.. the ZDB-GM accessory will be needed for limiting the angle-of-rotation.



Example: AM24-MFT(2)

Manual operation

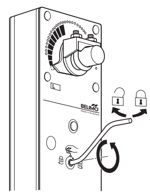
Manual operation NM.., AM.., GM..
Manual operation with self-resetting pushbutton (gearing disengaged while depressed).



Example:
AM24-MFT(2)

LF24-MFT(2): No manual operating facility

Manual operation AF24-MFT(2)
By hand crank; damper can be fixed in any position. Release is either manual or automatic by energising the power supply.



Manual operation NV.., NVF..(-E), AV..
See overleaf.